Contributions to a better Knowledge of the Pyrenomycetes.—II.

A NEW SPECIES OF ERGOT

By David Griffiths

After being led to believe that the fungus flora of the arid regions of southern Arizona was next to nil, the writer, while on a short trip in the San Pedro and Sulphur Spring Valleys, was more than pleased by finding several very interesting parasitic things as common and, in places as abundant, as in the moister and cooler regions of the North and the East. The principal object of the trip was the acquisition of seeds of native forage plants for experimentation. The greater number of the fungi secured were therefore, naturally associated with forage plants. No less than a dozen smuts and a much larger number of rusts were found in a short two-week trip. As far as the material has been studied, the most interesting parasitic fungus secured is a species of *Claviceps*, the description of which is the occasion for the present paper. A few general remarks on some of the characteristics of the parasitic fungus flora of the portions of the two valleys visited, together with that of the Santa Cruz in the vicinity of Tucson will be of some interest, and, possibly, pave the way for future publications.

It should be stated that the Sulphur Spring Valley is a basin rather than a valley and is of about 2000 feet greater altitude than the Santa Cruz, while the San Pedro is approximately an average between them. On account of the excessive drouths of the summer of 1900, the Santa Cruz was, during the month of October, almost devoid of the more valuable nutritious grasses. The Sulphur Spring, on the contrary, had a luxuriant growth of *Bouteloua*, *Aristida*, *Hilaria*, *Pappophorum*, *Chloris*, *Triodea*, and *Andropogon*. The San Pedro was about an average between the two. It is needless to state that the condition of the vegetation was a good index to the amount and the character of the precipitation which had occurred since the middle of July. The grasses which grew in such abundance in the higher valley occurred commonly

in each of the others but in diminishing quantities westward. The smuts with which the grasses were as badly affected in the higher altitudes were next to absent in the lower drier areas about Tucson in the Santa Cruz. Only one species of the smuts mentioned, and this in very small quantity on a single host, was found in the latter locality. This species was found in two stations near Tucson, one a poorly cultivated, irrigated field and the other a broad shallow wash on the mesa, which received the drainage of a considerable area. The hosts were common, however, in places within a radius of ten miles of Tucson. I think I have never met with a more striking example of the effect of drouth on the development of the smuts of native grasses.

It must also be borne in mind that the period of development of the parasitic fungi of this region is much shorter than it is in the regions favored with a more equable distribution of rainfall. Some of the hosts grow up and mature their seed in the short period of two months after the advent of the summer rains. The life of the fungus must likewise be subjected to the same shortening process. Indeed the parasitic fungi like their hosts necessarily spring into activity when the summer rains come and follow the advent of this agency as much as they do the seasonal variations of temperature.

These remarks are equally applicable to the species of ergot in question. There was plenty of the host (*Hilaria mutica*) of this interesting species found in the vicinity of Vale in the Santa Cruz valley, but careful search was required in order to ascertain the presence of sclerotia upon it, while they were exceedingly abundant wherever the host was found in the Sulphur Spring Valley. The space traveled over in the *Hilaria* region of the upper valley is estimated to have extended in the aggregate a distance of at least 15 miles, where there were patches of the grass every few rods. Scarcely any of it was free from the ergot. There was one locality on the railroad right-of-way near Cochise where the fungus was exceedingly abundant. The occurrence of an acre of grass making an excellent stand of hay with scarcely a head free from ergot would represent rather the extreme for the *Agropyron* and *Elymus condensatus* regions of the Northwest. Yet this represents exactly the condition on the so-called deserts of Arizona. The

vicinity of an abandoned roadbed, while covered with a rather shorter growth of grass than the remainder of the patch, was as badly infested as any the writer has ever seen. Here there was scarcely a perfect seed produced, each being replaced by the scle-

FIG. 1.

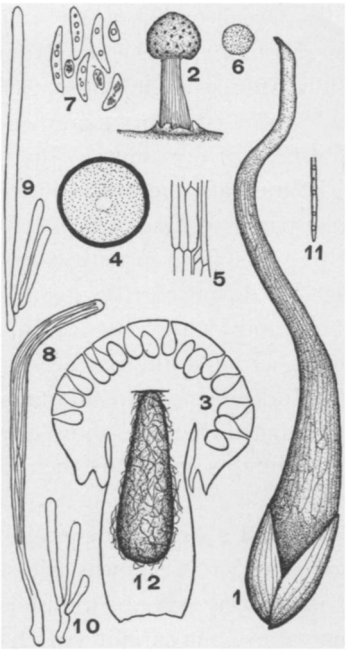

FIG. 2.

FIG. 1. Spike showing sclerotia.

FIG. 2. 1. Sclerotium, × 3. 2. Stroma, × 8. 3. Section of stroma, × 25, from microtome section. 4. Section of base of sclerotium, × 5. 5. Surface of sclerotium showing reticulations, × 8. 6. Section of sclerotium near the apex, × 10. 7. Conidia, × 285. 8. Ascus, × 285. 9 and 10. Groups of young asci, × 285. 11. Portion of a spore, × 600. 12. Perithecium, × 45.

rotium of an ergot. Several heads were found with as many as twenty sclerotia produced in each.

The development of the ascosporic stage from the sclerotium is of considerable interest and importance inasmuch as the sclerotia grow readily, whereas, every botanist who has attempted to cultivate the sclerotia of the various forms of *Claviceps purpurea*, knows how difficult and uncertain is their development. It is a

matter of common observation in the arid regions of the Southwest that in a very few days after a rain, whether this comes in July or September, the mesa reveals an abundance of seedlings which spring up and grow vigorously as long as favorable conditions obtain. It is well known that the seeds of some plants, at least, will germinate immediately upon maturity in marked contrast with the period of rest required by the seeds of the majority of the natives of the cooler and moister regions. Something analagous appears to be true regarding the development of the stroma from the sclerotium of this ergot. The proper conditions of heat and moisture cause them to develop immediately upon maturity, while, as is well known, the same structures in *Claviceps purpurea* apparently require a longer or shorter period of rest.

The sclerotia of this ergot were collected on the 16th of October in a sticky viscid condition. They were removed from the glumes of the grass and planted in clean building sand in the university greenhouse on the 26th of the same month. On the 25th of November, stromata containing mature ascospores were found in abundance. Previous experience in the germination of sclerotia led me to examine the cultures but casually, because they were not expected to develop inside of about two months. Not knowing, therefore, just when the stromata first appeared in this culture another lot of sclerotia was planted on the following day. These were carefully watched and sprinkled with water once each day for twenty days when mature stromata were again secured from the most superficial sclerotia. Both of the cultures continued to produce stromata until the first of January when they were abandoned. The development of mature stromata within twenty days of planting, especially when planting follows so closely upon the maturity of the sclerotia, I believe to be out of the ordinary experience.

It will be of interest to compare the above periods of development with the following data taken from my notes upon uncom-

Host plant.	Date of Collection.	Locality.	Date of Planting.	Date of Maturity of Stroma.	Period of Development.
Setanion elymoides.	Aug. 30, '98	Billings, Mont.	Oct. 29, '98	Feb. 20, '99	114 days
Elymus condensatus.	Aug. 22, '98	Buffalo, Wyo.	Oct. 29, '98	March 15, '99	137 days

pleted and unpublished experiments conducted in the greenhouse of Columbia University during the winter of 1898–99.

The above were planted under practically the same conditions as the Arizona specimens. The sclerotia from fifteen species of northwestern grasses were planted at this time, but only these three grew. On the 19th of January, duplicates of these fifteen specimens were planted, thoroughly moistened, and placed out of doors during freezing weather for two days. The first to show development were those of *Agropyron spicatum* which produced mature stromata in forty-four days. Without check cultures it can not be positively stated whether the shortening of the period was due to the freezing or to the natural consequence of the period of rest. The main point of interest results from a comparison of these periods of development with those of the Arizona species.

This species, which is very distinct in the sclerotial stage from all published species, may be characterized as follows:

Claviceps cinereum sp. nov.

Sclerotia clavate, gradually tapering upward, straight, curved, twisted or contorted, 1.5 to 3 cm. in length by 1.75 to 2.5 mm. in diameter at the base, very viscid while developing, the base permanently invested by the flowering glumes of the host, which are smooth, shining, black and closely adherent; smooth as far as covered by the glumes, but reticulated for some distance above this; the reticulations gradually disappearing upward and merging into closely placed longitudinal striations which in turn disappear near the apex, where the surface is nearly smooth or irregularly roughened; dark gray at base, but gradually fading out to a very light gray or almost white at the apex. In section the base possesses an external zone of a dark gray color on the outside, within which is a much wider distinctly marked zone of a very light gray, while the center, less definitely bounded, is almost pure white; at the apex these divisions are absent. Stroma erect, erumpent with a cylindrical or usually slightly fusiform, short, stout almost white stalk, and a subglobose head usually slightly flattened below and overlapping the upper end of the stalk, 1.75–2.75 mm. in diameter; head light gray, almost smooth, viscid, punctiform with small darker points indicating positions of perithecia. Perithecia sunken, not projecting above stromatic mass, ovate to very slightly pyriform, 190–225 μ × 60–90 μ. Asci 8-spored, fasciculated, narrowly cylindrical, slightly narrowed below into rather

long stout pedicels, and slightly enlarged at attachment, rounded above, 135–150 μ × 4–5 μ. Paraphyses wanting. Spores nearly parallel, filiform, coarsely but rather indistinctly guttulate, 100–120 μ × 1–1.5 μ.

Growing in inflorescence of *Hilaria mutica* and *H. cenchroides*, Cochise, Arizona, October, 1900.

UNIVERSITY OF ARIZONA, March, 1901.